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Applicant: Sato et al.
Docket: 10873.563US01
Title: METHOD AND APPARATUS FOR MANUFACTURING A FRAMEWORK FOR SHADOW MASK

CERTIFICATE UNDER 37 CFR 1.10

'Express Mail' mailing label number: EL544511973US

Date of Deposit: August 17, 2000

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By: *Linda McCormick*
Name: Linda McCormick

BOX PATENT APPLICATION
Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

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- ☒ Utility Patent Application: Spec. 14 pgs; 12 claims; Abstract 1 pgs.
- The fee has been calculated as shown below in the 'Claims as Filed' table.
- ☒ 6 sheets of formal drawings
- ☒ A signed Combined Declaration and Power of Attorney
- ☒ Assignment of the invention to Matsushita Electronics Corporation, Recordation Form Cover Sheet
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CLAIMS AS FILED

Number of Claims Filed	In Excess of:	Number Extra	Rate	Fee
Basic Filing Fee				\$690.00
Total Claims				
12	20	0	x 18.00	\$0.00
Independent Claims				
4	3	1	x 78.00	\$78.00
MULTIPLE DEPENDENT CLAIM FEE				\$0.00
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PATENT TRADEMARK OFFICE

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PATENT

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Applicant: Sato et al. Serial No.: unknown
Filed: concurrent herewith Docket No.: 10873.563US01
Title: METHOD AND APPARATUS FOR MANUFACTURING A FRAMEWORK
FOR PLANAR SHADOW MASK

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By: 

Name: Linda McCormick

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D. C. 20231

Dear Sir:

In connection with the above-identified application filed herewith, please enter the following preliminary amendment:

IN THE CLAIMS

In claim 6, line 1, please delete "or 2"

Please add the following new claim:

12. The method according to claim 2, wherein a basis point for positioning is provided at one point in the framework, and wherein when ends of the frames constituting two opposing sides are sheared respectively, positioning of each of the frames in a longitudinal direction is carried out using the basis point.

REMARKS

The above preliminary amendment is made to remove multiple dependencies from claims 6 and to add new claim 12.

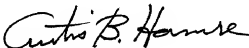
Applicants respectfully request that the preliminary amendment described herein be entered into the record prior to calculation of the filing fee and prior to examination and consideration of the above-identified application.

If a telephone conference would be helpful in resolving any issues concerning this communication, please contact Applicants' primary attorney-of record, Douglas P. Mueller (Reg. No. 30,300), at (612) 371.5237.

Respectfully submitted,

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METHOD AND APPARATUS FOR MANUFACTURING A FRAMEWORK FOR SHADOW MASK

FIELD OF THE INVENTION

5 The present invention relates to methods and apparatuses for manufacturing a framework for a shadow mask used in cathode ray tubes. In particular, the present invention relates to methods and apparatuses for forming end faces on which a shadow mask is mounted, in which when ends of two opposing side frames positioned in parallel of a rectangular framework are formed into, for example, a curved shape, and a shadow mask is stretched on the end faces, a cylindrical surface formed by the shadow mask can have cylindricity and curvature with high precision.

BACKGROUND OF THE INVENTION

15 In general, a shadow mask is mounted in a cathode ray tube by stretching it on a framework, which is assembled into a rectangular shape by means of welding etc. Usually, the framework is constructed by fixing a pair of long-side frames arranged horizontally to upper and lower ends of a pair of short-side frames, which are arranged vertically at a distance. Then, a shadow mask is stretched on screen side faces of the long-side frames.

20 The end faces of the long-side frames on which a shadow mask is stretched are usually formed into a predetermined curved shape (e.g. a circular arc shape with a radius R) so that their center portions become convex to the screen side.

25 Conventionally, the formation of curved end faces has been carried out by cutting or grinding after assembling the short-side and long-side frames into a rectangular form.

30 In the above-mentioned method, it is necessary to fix firmly the rectangular framework to be worked on. However, when the framework is fixed firmly, a deformation is generated in the rectangular framework. Furthermore, a rectangular framework bonded by welding often has a little distortion, and when it is fixed firmly in a working apparatus under this condition, a deformation resulting from the distortion is generated. Any of the above-mentioned deformations will be released when the framework is released from fixation after being worked on. Thus, no matter how precisely curved end faces are formed on a working apparatus, when the

framework is released from fixation after being worked on, so-called return distortion is generated in a worked portion. Due to the return distortion, the precision of the cylindricity and curvature of a shadow mask surface is difficult to be increased. Furthermore, in order to prevent return
5 distortion, there is a method of placing the rectangular framework precisely by a three-point supporting method. However, a high-level skill is required for the fixing method, and also productivity is inferior.

In the cutting or grinding process, when the strength of fixing the rectangular framework to a working apparatus is decreased so as to prevent
10 the above-mentioned generation of return distortion, it is required to carry out the working under a light load, so that it takes a long working time.

Moreover, labor is required for setting and removing the rectangular framework to and from a working apparatus, and it is extremely inefficient.

15 SUMMARY OF THE INVENTION

It is an object of the present invention to provide methods and apparatuses for manufacturing a framework for a shadow mask that solve the above-mentioned conventional problems, in which precision is increased for forming end faces of a rectangular framework on which a shadow mask
20 is mounted, working time is shortened considerably, operations of setting and removing the rectangular framework to and from a working apparatus are simplified, and working precision and production efficiency are satisfactory.

In order to accomplish the above object, the present invention
25 provides methods and apparatuses as follows:

A first method for manufacturing a framework for a shadow mask according to the present invention includes cutting ends on a screen side of frames constituting two opposing sides of a framework in a predetermined shape by shearing, thereby obtaining end faces on which a shadow mask
30 is stretched, wherein the framework is assembled in an approximately rectangular form.

A second method for manufacturing a framework for a shadow mask according to the present invention includes: assembling a framework in an approximately rectangular form; grinding a bottom face of the framework,
35 thereby forming a basis plane; and cutting ends on a side opposite to the basis plane of frames constituting two opposing sides of the framework in a predetermined shape by shearing, thereby obtaining end faces on which a

shadow mask is stretched.

According to the above first and second methods, the end faces on which a shadow mask is stretched are formed by shearing, and the shearing is carried out in only about several seconds. Thus, working time can be shortened considerably, and productivity of a framework for a shadow mask is improved significantly.

In the above second method, it is preferable that, when grinding the bottom face of the framework, the framework is placed on a grinding surface that is running, and the bottom face of the framework is ground while restricting movement of the framework in the running direction of the grinding surface. According to such a construction, in the subsequent shearing process, a basis plane for press-fixing the framework to an apparatus can be obtained at the bottom face speedily.

In the above, it is preferable that the bottom face of the framework is ground while substantially no pressurizing force other than the self-weight of the framework is applied in the direction perpendicular to the grinding surface. Accordingly, no external force other than the self-weight acts on the framework when forming the basis plane. Thus, the so-called return distortion is not generated after the grinding, and a basis plane having a very high flatness can be obtained.

In the above second method, it is preferable that when the shearing is carried out, the framework is fixed using the basis plane as an application surface. Accordingly, the so-called return distortion is not generated after the shearing. Furthermore, precision of the distance between the basis plane and the end faces formed by shearing can be increased, and also the generation of a tilt of the end faces with respect to the basis plane can be prevented.

In the above second method, it is preferable that a basis point for positioning is provided at one point in the framework, and that when ends of the frames constituting two opposing sides are sheared respectively, the positioning of each of the frames in a longitudinal direction is carried out using the basis point. Accordingly, the longitudinal positions of the two end faces formed on the two opposing sides can be allowed to coincide, so that a cylindrical surface formed by a shadow mask stretched on the end faces that are formed into, for example, a curved shape can realize very high cylindricity and accurate curvature.

A grinding apparatus for a framework for a shadow mask according

to the present invention includes: a grinding surface that is running; and a stopper for preventing a framework from moving in a running direction of the grinding surface when the framework is placed on the grinding surface, wherein the framework is assembled in an approximately rectangular form.

5 According to this apparatus, a basis plane for press-fixing the framework to an apparatus in the subsequent shearing process can be obtained speedily.

In the grinding apparatus, it is preferable that substantially no pressurizing force other than the self-weight of the framework is applied in the direction perpendicular to the grinding surface. Accordingly, when
10 forming the basis plane, no external force other than the self-weight acts on the framework. Thus, the so-called return distortion is not generated after the grinding, and a basis plane with a very high flatness can be obtained.

Furthermore, in the grinding apparatus, it is preferable that the grinding surface is a circulating grinding belt, with the grinding belt sliding
15 on a flat-plate shaped bed, and the framework is placed so as to face the bed. Accordingly, a basis plane with a high flatness can be obtained with a simple structure.

A shearing apparatus for a framework for a shadow mask according to the present invention includes: a die for cutting faces of frames
20 constituting two opposing sides of a framework in a predetermined shape by shearing, wherein the framework is assembled in an approximately rectangular form and has a bottom face as a basis plane, and the faces are on a side opposite to the basis plane; a frame position controlling unit for positioning each of the frames in a longitudinal direction; a base on which
25 the basis plane is applied; and a clasper for press-fixing the framework on the base. According to this apparatus, the end faces on which a shadow mask is stretched can be formed by shearing, so that working time can be shortened considerably, and productivity is improved significantly. Furthermore, when shearing is carried out, because the framework is
30 press-fixed on the base at the basis plane, the framework is not deformed when it is press-fixed. Accordingly, the so-called return distortion is not generated when the framework is released from the press-fixing after the shearing, and end faces on which a shadow mask is mounted can be formed with high precision.

35 In the shearing apparatus, it is preferable that when the frames constituting two opposing sides are sheared respectively, positioning of each of the frames is carried out by the frame position controlling unit using a

common basis point provided in the framework. Accordingly, longitudinal positions of the two end faces formed on the two opposing sides can coincide, so that a cylindrical surface formed by a shadow mask stretched on the end faces that are formed into, for example, a curved shape can realize very high
5 cylindricity and accurate curvature.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic perspective view showing a configuration of a framework for a shadow mask obtained according to the present invention.

10 Fig. 2 is a diagram showing a configuration of a framework for a shadow mask obtained according to the present invention: Fig. 2 (A) is a bottom view; Fig. 2 (B) is a left side view; and Fig. 2 (C) is a front view.

Fig. 3 is a schematic diagram showing a condition in which a basis plane of a rectangular framework is ground using a grinding apparatus of
15 the present invention.

Fig. 4 is a side view showing a condition in which a rectangular framework is set in a shearing apparatus of the present invention.

Fig. 5 is a front view of a shearing apparatus of the present invention, which is viewed from the side of a bottom face (a basis plane) of a rectangular framework.
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Fig. 6 is a partially enlarged side view showing a configuration of a clamper in a shearing apparatus of the present invention.

PREFERRED EMBODIMENTS OF THE INVENTION

25 In the following, embodiments of the present invention are described referring to Figs 1 to 6.

Fig. 1 is a schematic perspective view showing a configuration of a framework for a shadow mask. Fig. 2 also shows a configuration of a framework for a shadow mask: Fig. 2 (A) is a bottom view; Fig. 2 (B) is a left
30 side view; and Fig. 2 (C) is a front view.

As shown in the drawings, a framework 10 for a shadow mask (a rectangular framework; hereinafter also may simply referred to as "framework") comprises a pair of short-side frames 11a and 11b arranged in parallel, and a pair of long-side frames 12a and 12b arranged in parallel, in which ends of the short-side frames 11a and 11b are bonded to ends of the long-side frames 12a and 12b by welding. The short-side frames 11a and 11b are constructed by folding a metal flat plate in an approximately open
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box shape in cross section. The long-side frames 12a and 12b are constructed by folding a metal flat plate in an approximately triangular shape in cross section. The metal flat plates of the long-side frames 12a and 12b are extended to the side opposite to the short-side frames 11a and 11b (screen side in a cathode ray tube), and a shadow mask is stretched on end faces 13a and 13b, which are ends of the metal flat plate. The end faces 13a and 13b are formed into a shape of a circular arc curve having a predetermined radius R of curvature, so that they are convex to the side opposite to the short-side frames 11a and 11b (screen side in a cathode ray tube).

In this embodiment, the cylindricity of a cylindrical surface 15 (shadow mask surface) formed by the opposing end faces 13a and 13b positioned in parallel is not more than 0.05 mm in the degree of torsion, and cylindricities of end faces 13a and 13b are respectively not more than ± 0.05 mm. In this embodiment, the cylindricities of the end faces 13a and 13b are different from the cylindricity of the cylindrical surface 15 (shadow mask surface) formed by the end faces 13a and 13b. Even if the end faces 13a and 13b are perfectly cylindrical surfaces, for example, when the center axes of both cylindrical surfaces do not coincide, the surface of the shadow mask stretched on the end faces does not become perfectly cylindrical. In this embodiment, by using the method and apparatuses of the present invention described below, the end faces 13a and 13b can be formed into a curved shape with high precision within the above range of tolerance.

In the following, the method and the apparatuses of this embodiment are described.

First, short-side frames 11a and 11b and long-side frames 12a and 12b that are obtained by pressing metal flat plates are assembled into a rectangular form and are welded integrally as shown in Figs. 1 and 2. Then, the integrated assembly is annealed to remove intrinsic stresses due to the pressing and welding. At this time, end faces 13a and 13b of the long-side frames 12a and 12b are not formed yet, and as shown by alternate long and two short dashes lines 14a and 14b in Fig. 2 (C), the metal flat plates extend to the side opposite to the short-side frames 11a and 11b.

Next, in the framework thus obtained, bottom faces (faces of the short-side frames on the side not bonded to the long-side frames), which are to be a basis plane, are ground using a grinding apparatus 50 of a belt grinder system shown in Fig. 3. The basis plane 17 obtained by the

grinding becomes a basis when fixing the framework in a shearing apparatus in the subsequent shearing process.

In Fig. 3, numeral 51 denotes a driving motor; 52 denotes a V-belt for transmitting the power of the driving motor to a driving roller 53; 54a and 54b denote trailing rollers; 55a and 55b denote two belt-shaped grinding papers that are run circularly by the driving roller 53 and the trailing rollers 54a and 54b; 56 denotes a bed having a top surface precisely manufactured with a flatness precision of not more than one hundredth millimeter; and 57a and 57b denote a pair of receiving metallic parts as stoppers.

A framework 10 is placed so that the basis plane 17 of the short-side frames 11a and 11b respectively corresponds to the grinding papers 55a and 55b that are running at a high speed. The two grinding papers 55a and 55b slide closely on the common bed 56, and the framework 10 is placed so as to face the bed 56. Thus, even if the framework 10 is placed, the surfaces of the grinding papers 55a and 55b do not sink and keep flat surfaces with a precision as high as that of the bed 56. Movement of the framework 10 in the running direction of the grinding papers 55a and 55b is stopped by the receiving metallic parts 57a and 57b.

The framework 10 in which intrinsic stresses have been removed through annealing after the welding has generated a little distortion in flatness. However, the bottom faces of the framework 10 are placed on the two grinding papers 55a and 55b respectively, and the bottom faces are ground under a load of only the self-weight of the framework 10 in a free condition, without using any fixing measure except for restricting movement in the running direction of the grinding papers 55a and 55b. Thus, the framework 10 is not distorted during the grinding, and a basis plane 17 with a high flatness precision can be obtained. According to this method, the so-called return distortion is not generated, and a basis plane that is ground precisely with a flatness precision not more than one hundredth millimeter can be formed at the bottom faces of the framework 10. When such a basis plane with high precision can be formed, even if the basis plane is applied on an apparatus to be clamped with a necessary fixing force in the subsequent process of forming curved end faces, the framework 10 is not distorted, and the so-called return distortion is not generated after the working.

In the framework 10 in which the basis plane 17 is formed, linear

ends 14a and 14b of the long-side frames before being worked as shown in Fig. 2 (C), which are indicated by an alternate long and two short dashes line, are cut by shearing using a shearing apparatus 100 shown in Figs. 4 to 6, and are formed into a curved shape.

Fig. 4 is a side view showing a condition in which the framework 10 is set in the shearing apparatus 100. Fig. 5 is a front view of the shearing apparatus 100, which is viewed from the side of a bottom face (basis plane) of the framework 10. In Fig. 5, the framework 10 is indicated by an alternate long and two short dashes line for simplification.

In Fig. 4, a lower die 105a and an upper die 105b function as shearing edges by both dies biting each other. The shearing edge has been manufactured to have a shape of a circular arc curve so that the linear upper ends 14a and 14b of the long-side frames can be sheared with a desired radius of curvature R. The upper die 105b is fixed to a column 109 of the pressing apparatus 100 so as to be movable up and down. The lower die 105a is fixed to a base. When the upper die 105b descends to carry out shearing, it is moved while sliding on a surface of back-up 106 at its back face. Accordingly, escape of the upper die 105b is prevented, and draught clearance between the upper die 105b and the lower die 105a is kept constant.

A pad 108 supported with a spring 107 is arranged between the lower die 105a and the back-up 106 so that the upper face of the pad 108 is in the same plane as the upper face of the lower die 105a. Accordingly, the shearing can be carried out while sandwiching a cut-side material between the upper die 105b and the pad 108, so that a material on the cut side of the end of the frame can be prevented from escaping in the shearing.

The framework 10 is set in the shearing apparatus 100 as follows:

In a condition in which the long-side frames 12a and 12b of the framework 10 are positioned horizontally and the short-side frames 11a and 11b are positioned vertically, the long-side frame 12a on the lower side is placed on the lower die 105a, and the basis plane 17 as bottom faces of the framework 10 is placed against faces 103a' and 103b' of bases 103a and 103b, which are positioned vertically in the shearing apparatus 100.

The bases 103a and 103b provided at right and left in a pair have faces 103a' and 103b' respectively against which the framework is applied, which maintain predetermined precisions so as to form an identical plane as well as to cross at right angles the center line of a circular arc of the upper

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and lower dies 105a and 105b with a radius R of curvature. Accordingly, the framework 10 can be fixed on the bases 103a and 103b with clampers at four corners, which are described below, without having a distortion. Also, when linear ends 14a and 14b of the long-side frames 12a and 12b of the framework 10 before a working are sheared to form a shape of a circular arc, size precision of the distance H (see Fig. 2 (C)) between the top of the circular arcs of the obtained end faces 13a and 13b and the basis plane 17 as bottom faces of the framework 10 can be maintained. Furthermore, the center lines C (see Fig. 2 (C)) of the circular arcs of the end faces 13a and 13b can cross the basis plane 17 at right angles. Furthermore, uniform precision of the distances between a cylindrical surface formed by the end faces 13a and 13b and the basis plane 17 can be maintained.

Next, in the framework 10, the position of the framework 10 in the long-side direction is controlled by a frame position controlling unit. The frame position controlling unit comprises: a handle 111; a linkage 112 which moves up-and-down linked with the operation of the handle 111; and two position-controlling pins 113a and 113b, which are provided as a pair in the up-and-down direction, and are held for horizontal movement linked with the up-and-down movement of the linkage 112. The linkage 112 has a yoke-type structure, in which, by operating the handle 111, two position-controlling pins 113a and 113b are inserted alternatively in the center holes 16a and 16b (see Fig. 2 (A)), which function as basis points for positioning and are provided at the centers of the long-side frames 12a and 12b of the framework 10 in the longitudinal direction. The linkage 112 is arranged so that the two pins 113a and 113b are not inserted in the center holes 16a and 16b simultaneously.

Using the frame position controlling unit that is configured as described above, the lower position-controlling pin 113a is inserted in the center hole 16a of the long-side frame 12a (see Fig. 2 (A)) by operating the handle 111.

In this state, the framework 10 is fixed closely on the bases 103a and 103b with clampers 130a, 130b, 130c and 130d provided at four corners.

Fig. 6 shows an enlarged side view of the clasper 130a at a right lower portion in Fig. 5. The claspers provided at four corners have the same basic construction as the clasper 130a in Fig. 6.

Each clasper comprises: a clamping hook 131 for press-fixing the short-side frame 11a (or 11b) on the base 103a (or 103b), which is mounted

at a tip of the clamper; a clamping cam 132 for generating a force for fixing the framework 10; a round-bar shaped connecting pole 133 for connecting the clamping hook 131 and the clamping cam 132 and for moving the clamping hook 131 horizontally as well as rotating it around the axis of the connecting pole 133; a handle 134 that is fixed to the clamping cam 132 for operating the clamping cam 132 and for moving horizontally and rotating the clamping hook 131; and a cam pedestal 135 for keeping the connecting pole 133 to be horizontally movable as well as rotatable and for generating a clamping force by making contact with the clamping cam 132. The cam pedestal 135 is fixed on the base 103a (or 130b) with a screw, after adjusting the clamping force of the clamping cam 132, with a long hole parallel to the axial direction of the connecting pole 133. The clamping hook 131 is pole-shaped (e.g. a square pole) and is connected to the connecting pole 133 at a position away from the center to one side in the longitudinal direction of the clamping hook 131.

The procedure for operating the clamper is as follows: Before setting the framework 10, the clamping hook 131 is put in a condition in which it is recessed below the faces 103a' and 103b' of the bases 103a and 103b (a state as indicated by an alternate long and two short dashes line in Fig. 6), and the framework 10 is inserted between the bases 103a and 103b and a column 109 from a lateral side of the shearing apparatus 100. Then, the basis plane 17 of the framework 10 is placed on the faces 103a' and 103b' of the bases 103a and 103b, and the position-controlling pin 113a on the lower side of the frame position controlling unit is inserted in the center hole 16a of the long-side frame 12a. Then, the connecting pole 133 is caused to slide forwardly with the handle 134 and then it is rotated, so that the clamping hook 131 is hooked on the short-side frames 11a and 11b of the framework 10. The connecting pole 133 is pulled up by moving the handle 134 upward or downward to an approximately perpendicular position and making the clamping cam 132 in contact with a lateral side of the cam pedestal 135, so that the framework 10 is press-fixed on the bases 103a and 103b with the clamping hook 131.

Furthermore, the procedure for releasing the framework from clamping is as follows: The handle 134 is moved rotationally upward or downward in a direction so as to loosen the clamping cam 132, and further is rotated around an axis of the connecting pole 133, so that the clamping hook 131 is released from hooking from the short-side frames 11a and 11b.

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The clamping hook 131 is recessed below the faces 103a' and 103b' by pulling up the handle 134 to the front, and the framework is removed.

In the method of fixing the framework 10 with a clasper of such a configuration, the clamping force of fixing the framework can be kept constant all times, and generation of excessively large or small clamping forces of the framework 10 due to individual differences can be prevented. Thus, deformation of the framework 10 due to non-uniformity in the clamping force can be prevented, and generation of so-called return-distortion can be prevented. Furthermore, a large clamping force can be generated by operating a handle with a small force because of the principle of lever. Moreover, the framework 10 can be fixed as well as can be released from the fixing speedily with a simple structure.

By setting the framework 10 in the shearing apparatus 100 as described above, the center line of the circular arc curve of the upper and lower dies 105a and 105b can coincide with the center lines of the framework 10, that is, the center lines C of the circular arc curves of the end faces 13a and 13b shown in Fig. 2.

By moving downward the upper die 105b attached to the column 109 of the pressing apparatus 100 and shearing the end 14a of the long-side frame 12a of the framework 10 into a predetermined curved shape with the upper and lower dies 105a and 105b, formation of a curved shape of one side end face 13a is completed. By carrying out shearing, formation of a curve end face can be completed within a short time of only several seconds.

Next, the frame 1 is turned upside down, and a curved shape of an end face 13b of the long-side frame 12b on the other side is formed. The method of setting the framework 10 as well as the order and method of forming a curved shape are basically the same as the above. However, at this time, the position-controlling pin 113b on the upper side of the frame position controlling unit is inserted in the center hole 16a of the long-side frame 12a, in which a curved end face 13a has been already formed. That is, at both two times of shearing operations, position of the framework is controlled using a common basis point, namely, a center hole formed in the long-side frame on the same side (in the above example, the center hole 16a). Thus, even if there is a little deformation in a direction in a plane when assembling the framework 10 in a rectangular form (for example, in a case in which the long-side frames and the short-side frames are not connected at right angles, and the framework 10 is slightly distorted in the shape of a

parallelogram), when the framework 10 is turned upside down after forming an end face on one side, the position of the center line C (see Fig. 2(C)) of the circular arc curve of the previously-formed end face in the horizontal direction can coincide with the position of the center line of the circular arc curve of the dies 105a and 105b in the horizontal direction. Thus, the center lines C of respective circular arc curves of the two end faces 13a and 13b as finally obtained can coincide. That is, center points of both circular arcs can coincide. As a result, a framework that maintains the cylindricity of a cylindrical surface formed by the end faces 105a and 105b can be manufactured.

Furthermore, the center hole 16b provided in the long-side frame 13b is used as needed when assembling the framework, but is not used for positioning in the shearing.

Although an example in which end faces on the screen side of long-side frames are sheared into a curved shape has been described in the above, the present invention is not limited to this example. The present invention also can be applied to the case in which end faces of long-side frames are sheared in a straight shape and a planar shadow mask is manufactured.

As mentioned above, according to the present invention, a basis plane for forming end faces of frames is produced by grinding bottom faces of a rectangular framework in free condition without applying any pressure to the framework, so that no return distortion is generated after the grinding, and a basis plane having a flatness with high precision of not more than one hundredth milimeter can be formed.

If such precision of the basis plane is maintained, when forming end faces on which a shadow mask is mounted, even if the basis plane is applied on an apparatus to be clamped with a necessary fixing force, no distortion is generated after the working. Thus, end faces with high precision can be formed by shearing using a conventional pressing machine with dies. Moreover, because shearing is employed, the working can be carried out rapidly in only several seconds.

Thus, because formation of end faces is enabled by a rapid shearing with high precision, expensive investment for introducing specialized working equipment can be reduced and equipment investment is minimized, and also working time is allowed to be at least 10 times more efficient than ever, so that significant effects can be obtained in terms of quality and productivity.

Furthermore, with respect to the grinding apparatus of a belt grinder system for a basis plane, by running two belt-like grinding papers closely on a bed, flat surfaces that are ground with a high flatness precision as mentioned above can be obtained, and a basis plane of a rectangular framework can be formed rapidly with high precision. Furthermore, the apparatus does not require any jig for fixing the rectangular framework other than a jig for preventing the rectangular framework from moving in the running direction of the grinding belt, so that cost of equipment can be reduced.

Furthermore, with respect to the shearing apparatus for forming, for example, a curved shape for the end faces of the frames on which a shadow mask is mounted, because positioning is carried out by inserting a position-controlling pin in one center hole provided in a rectangular framework at two times in the shearing operations, the center lines of the circular arc curves formed on two sides of the framework can coincide. Also, because the clasper for fixing the framework uses a cam for clamping, the framework can be fixed by clamping with a predetermined clamping force, generation of return distortion due to non-uniformity of the clamping force can be prevented, and operations of setting and removing the framework can be simplified. Accordingly, the center line of the circular arc curve of the dies and the center lines of the circular arc curves on two sides of the framework can coincide with high precision, and the cylindricity of a cylindrical surface formed by end faces on two sides, on which a shadow mask is mounted, can be improved. Furthermore, the shearing apparatus of the present invention can be configured by setting necessary equipment in a conventional pressing machine. Moreover, shearing into a predetermined shape can be carried out instantly with the dies set in the apparatus.

Thus, apparatuses with stable qualities and improved production efficiencies can be provided at minimum costs.

Finally, it is understood that the invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The embodiments disclosed in this application are to be considered in all respects as illustrative and not restrictive, so that the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are intended to be

embraced therein.

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What is claimed is:

1. A method for manufacturing a framework for a shadow mask, which comprises cutting ends on a screen side of frames constituting two
5 opposing sides of a framework in a predetermined shape by shearing, thereby obtaining end faces on which a shadow mask is stretched, wherein the framework is assembled in an approximately rectangular form.

2. A method for manufacturing a framework for a shadow mask,
10 which comprises:
assembling a framework in an approximately rectangular form;
grinding a bottom face of the framework, thereby forming a basis
plane;

cutting ends on a side opposite to the basis plane of frames
15 constituting two opposing sides of the framework in a predetermined shape by shearing, thereby obtaining end faces on which a shadow mask is stretched.

3. The method according to claim 2, wherein when grinding the
20 bottom face of the framework, the framework is placed on a grinding surface that is running, and the bottom face of the framework is ground while restricting movement of the framework in a running direction of the grinding surface.

4. The method according to claim 3, wherein the bottom face of the
25 framework is ground while substantially no pressurizing force other than a self-weight of the framework is applied in a direction perpendicular to the grinding surface.

5. The method according to claim 2, wherein when the shearing is
30 carried out, the framework is fixed using the basis plane as an application surface.

6. The method according to claim 1 or 2, wherein a basis point for
35 positioning is provided at one point in the framework, and wherein when ends of the frames constituting two opposing sides are sheared respectively, positioning of each of the frames in a longitudinal direction is carried out

using the basis point.

7. A grinding apparatus for a framework for a shadow mask,
comprising: a grinding surface that is running; and a stopper for preventing
5 a framework, which is assembled in an approximately rectangular form,
from moving in a running direction of the grinding surface when the
framework is placed on the grinding surface.

8. The grinding apparatus according to claim 7, which applies
10 substantially no pressurizing force other than a self-weight of the
framework in a direction perpendicular to the grinding surface.

9. The grinding apparatus according to claim 7, wherein the
grinding surface is a circulating grinding belt, the grinding belt sliding on a
15 flat-plate shaped bed, and the framework is placed so as to face the bed.

10. A shearing apparatus for a framework for a shadow mask,
comprising:

a die for cutting ends of frames constituting two opposing sides of a
20 framework in a predetermined shape by shearing, wherein the framework is
assembled in an approximately rectangular form and has a bottom face as a
basis plane, and the ends are on a side opposite to the basis plane;

a frame position controlling unit for positioning each of the frames
in a longitudinal direction;

25 a base against which the basis plane is placed; and
a clamber for press-fixing the framework on the base.

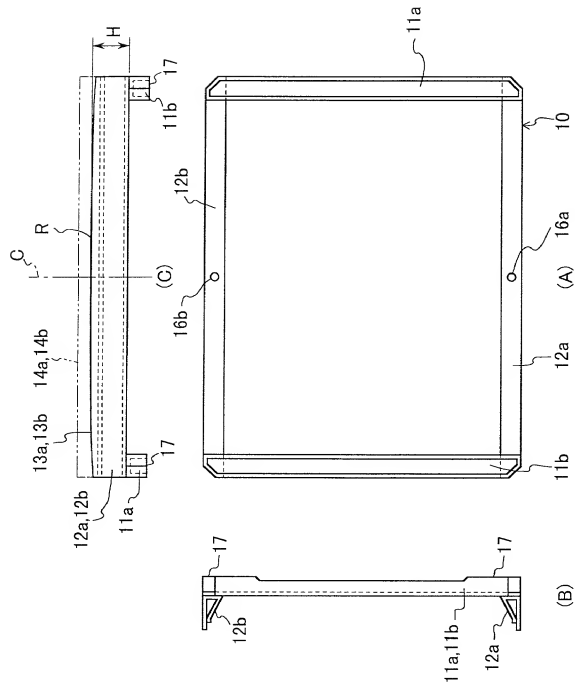
11. The shearing apparatus according to claim 10, wherein when
the frames constituting two opposing sides are sheared respectively,
30 positioning of each of the frames is carried out by the frame position
controlling unit using a common basis point provided in the framework.

ABSTRACT

After assembling a framework in an approximately rectangular form, a basis plane is formed by grinding a bottom surface of the framework. Then, ends of two opposing sides of the framework on a side opposite to the basis plane are cut in a predetermined shape by shearing. The grinding can be carried out by placing the framework on a grinding surface that is running, while applying substantially no pressurizing force other than the self weight of the framework. According to this method, precision of forming end faces of a framework on which a shadow mask is mounted can be improved. Also, working time can be shortened.

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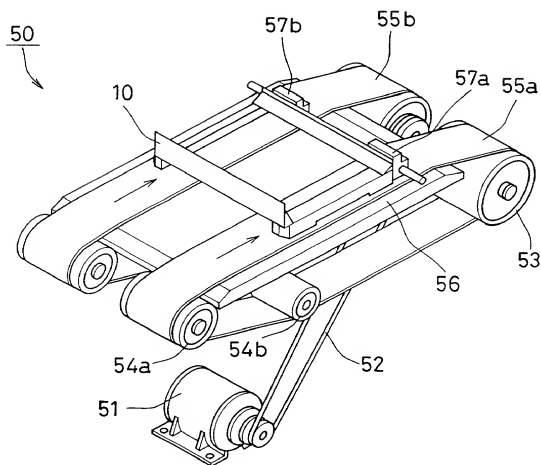


FIG . 3

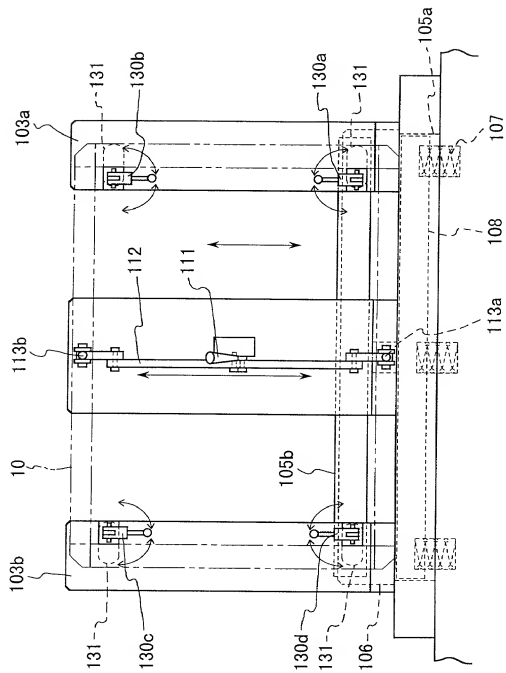


FIG. 5

MERCHANT & GOULD P.C.
United States Patent Application

COMBINED DECLARATION AND POWER OF ATTORNEY

As a below named inventor I hereby declare that: my residence, post office address and citizenship are as stated below next to my name; that

I verily believe I am the original, first and sole inventor (if only one name is listed below) or a joint inventor (if plural inventors are named below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: **METHOD AND APPARATUS FOR MANUFACTURING A FRAMEWORK FOR SHADOW MASK**

The specification of which

- a. ☒ is attached hereto
b. ☐ was filed on _____ as application serial no. _____ and was amended on _____
(if applicable) (in the case of a PCT-filed application) described and claimed in international no. _____ filed
and as amended on _____ (if any), which I have reviewed and for which I solicit a United States patent.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, § 1.56 (attached hereto).

I hereby claim foreign priority benefits under Title 35, United States Code, § 119/365 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on the basis of which priority is claimed:

- a. ☐ no such applications have been filed.
b. ☒ such applications have been filed as follows:

FOREIGN APPLICATION(S), IF ANY, CLAIMING PRIORITY UNDER 35 USC § 119			
COUNTRY	APPLICATION NUMBER	DATE OF FILING (day, month, year)	DATE OF ISSUE (day, month, year)
Japan	11-250106	3 September 1999	
ALL FOREIGN APPLICATION(S), IF ANY, FILED BEFORE THE PRIORITY APPLICATION(S)			
COUNTRY	APPLICATION NUMBER	DATE OF FILING (day, month, year)	DATE OF ISSUE (day, month, year)

I hereby claim the benefit under Title 35, United States Code, § 120/365 of any United States and PCT international application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. APPLICATION NUMBER	DATE OF FILING (day, month, year)	STATUS (patented, pending, abandoned)

I hereby claim the benefit under Title 35, United States Code § 119(e) of any United States provisional application(s) listed below:

U.S. PROVISIONAL APPLICATION NUMBER	DATE OF FILING (Day, Month, Year)

I hereby appoint the following attorney(s) and/or patent agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith:

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Lacy, Paul E.	Reg. No. 38,946		

I hereby authorize them to act and rely on instructions from and communicate directly with the person/assignee/attorney/firm/organization who/which first sends/sent this case to them and by whom/which I hereby declare that I have consented after full disclosure to be represented unless/until I instruct Merchant & Gould P.C. to the contrary.

Please direct all correspondence in this case to Merchant & Gould P.C. at the address indicated below:

Merchant & Gould P.C.
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Minneapolis, MN 55402-0903

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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			Kounosuke OKUMURA August 9, 2000	

§ 1.56 Duty to disclose information material to patentability.

(a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is canceled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is canceled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§ 1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

- (1) prior art cited in search reports of a foreign patent office in a counterpart application, and
- (2) the closest information over which individuals associated with the filing or prosecution of a patent

application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.

(b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made of record in the application, and

(1) It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a claim;

(2) It refutes, or is inconsistent with, a position the applicant takes in:

- (i) Opposing an argument of unpatentability relied on by the Office, or
- (ii) Asserting an argument of patentability.

A prima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

(c) Individuals associated with the filing or prosecution of a patent application within the meaning of this section are:

- (1) Each inventor named in the application;
- (2) Each attorney or agent who prepares or prosecutes the application; and

(3) Every other person who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.

(d) Individuals other than the attorney, agent or inventor may comply with this section by disclosing information to the attorney, agent, or inventor.